Findings of a Basic Water & Effluent Survey Carried Out at Moray Seafoods Limited

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1. Introduction

As part of the North East Scotland Strategic Study, Seafish has been involved in briefly visiting representative companies in the region to survey water use and effluent production. The purpose of these visits is to estimate the general reductions in both water use and effluent strength which could be made by introducing waste minimisation. This report summarises the findings of the brief visit to Moray Seafoods Limited carried out on 4th May 1999.

These brief visits of approximately half day duration only provide an initial indication of the water and effluent problems of each business and of what can be done about those problems. Few measurements of water usage and none of effluent strength were made but the visits have enabled comparison with other businesses where detailed water and effluent audits and further work have been carried out. The problems and the required waste minimisation measures are often common to many businesses.

Some obvious problems and appropriate waste minimisation measures have been identified in this report, but this should not be considered as a substitute for the extensive water and effluent audit and the implementation of a targeted waste minimisation programme as recommended in the Seafish document "Guidance for Fish Processors on Water and Effluent Minimisation".

2. Background Information

Moray Seafoods Limited primarily processes *Pandalus borealis* and *Nephrops norvegicus*. The company has about 130 employees. The main processes are:

Nephrops norvegicus	-	washing and grading
	-	hand peeling
	-	mechanised peeling
Pandalus borealis	-	washing
	-	cooking
	-	peeling

Enrobing
Cleaning
Boxwashing
Packing

The company has introduced a number of water minimisation measures including a re-circulatory system to part of the *Pandalus borealis* process, good housekeeping measures and trigger operated sprays on manual peeling lines; which have reduced water use considerably. In addition, the company believes water use in other areas has been reduced to the minimum required without affecting the product hygiene or operation of the equipment.

In terms of effluent production, the company screens the re-circulated water and the water discharged from the main process area, uses catch baskets and has modified the drainage system in the enrobing area to remove any enrobing effluent for alternative disposal.

Due to the complexity of the operation and inaccessibility of pipework it was not possible to monitor each water usage point/area during the brief survey.

In addition the factory was not in full production due to supply shortages. Therefore, the water consumption (total and *Pandalus borealis* line) over the time spent on site (11 am to 15.30 pm) is not representative of normal working practices.

Monitoring the main site meter over a period of 4.5 hours (11 am to 15.30 pm) identified that 148.4m^3 of water was used. Of this, approximately 4.3m^3 was used in processing *Pandalus borealis* (independently metered). During the period of the survey, there was a lunch break when processing was not carried out.

It was not possible to observe cleaning and box washing operations during this brief survey.

3. The Process Operations

3.1 Nephrops norvegicus Washing and Grading

3.1.1 Water Use

The washers use water on an empty and fill basis where the water is changed when required. Wastage was not evident.

3.1.2 Effluent Production

Problem areas:

- When the wash tank is emptied, a large amount of waste and debris is discharged down the drain.
- The boxes to catch the graded *Nephrops norvegicus* were mis-aligned, resulting in product ending up on the floor. Apart from the wastage of product, if it is left underfoot and trampled and washed into the drain it will also add to the strength of the effluent.

Recommendations:

- Dispose of settled solid waste from the bottom of the hopper directly into the bin. Use an effective wedge wire catch basket to prevent solids entering the drain (see Section 3.7).
- Use suitable boxes or improve the design of the grader chutes to ensure waste does not end up on the floor.

3.2 Mechanised *Nephrops norvegicus* Peeling

3.2.1 Water Use

The machine was not in operation for a long enough period to be studied thoroughly. However, as flow rates have been monitored by the factory it is assumed that there is no significant water wastage in this area. Water flow rates to the machine should be regularly checked to ensure they are in line with the minimum required level. A flow regulator could be installed to maintain the optimum flow.

3.2.2 Effluent Production

Problem areas:

- Some waste ended up on the floor underneath the machine.

If the waste water washes through the shell waste after leaving the machine, a separator chute could be used to prevent the washing out of additional organic material which can significantly increase the effluent strength (see Seafish Guidelines). In trials with a white fish skinning machine, a wedge wire separator chute reduced effluent strength by 60%. Catch trays or guards should be used to prevent waste ending up on the floor.

3.3 Manual *Nephrops norvegicus* Peeling

3.3.1 Water Use

Manually operated trigger sprays are used, resulting in little water wastage.

3.3.2 Effluent Production

Problem areas:

- Waste shells are dropped into baskets at the edge of the tables, however, a significant amount ends up on the floor as the baskets are difficult to place correctly. This waste is then left on the floor and trampled underfoot.
- The effluent from the tables either ends up on the floor directly or drains into one of the waste baskets, washing through the waste and then onto the floor, which will increase the strength of the effluent.

Recommendations:

- Incorporating waste chutes into the tables will ensure all waste ends up in the baskets. Baskets should be emptied regularly and the contents not allowed to spill over on to the floor.
- Waste on the floor should be shovelled up as soon as possible.
- Table design should ensure that effluent is ducted away from the waste baskets to prevent washing through the waste (see 3.2.2 above).

3.4 *Pandalus borealis* Processing Line

3.4.1 Water Use

Water is required to ensure a high standard of hygiene and effective operation of the equipment. During the survey it was not possible to assess water consumption in each area of this process. Due to the nature of the process, it would be unwise to speculate on areas of wastage or areas where reductions in the water consumption could be made, without studying the process in depth. This is outside the scope of this survey. However, it should be noted that Scandinavian work has shown that considerable savings can be made in such process lines (reported in 'Best Available Technology in the Fishing Industry', 1997 ISBN 92-893-0091-4, available from the Nordic Council of Ministers). It may also be worth contacting the equipment manufacturers to determine whether there are any modifications which could be made to reduce water use.

3.4.2 Effluent Production

The same caveats apply as to the water use, however the following obvious points are noted.

Problem areas:

- Waste gets onto the floor from emptying the wash tanks and reception hoppers. In the processing area, peeled product also ends up on the floor.

Recommendations:

- Dispose of settled solid waste from the bottom of the hopper directly into a waste bin.
- Use an effective catch basket to prevent solids entering the drain (see Section 3.7).
- Use suitable collection boxes to ensure waste does not end up on the floor.

3.5 Waste Screening Area

Where possible, waste should be separated at source (e.g. by fitting wedge wire separator chutes to the processing equipment) rather than passing into the draining channels for subsequent screening. Organic materials dissolve into the water and will accumulate in the recycled water, and are then not removable by screening.

3.5.1 Effluent Production

Problem areas

- During the survey, the pipes underneath the screens were inadequately joined or had a missing seal, resulting in a large volume of effluent pouring over the floor into the drain.
- A significant amount of shell ends up on the floor around the waste conveyor.
- Waste ends up on the floor around the catch basket underneath the screw conveyor, as the basket is infrequently emptied.

Recommendations

- Pipes carrying effluent/water should be regularly maintained and any problems, such as leaks, resolved as soon as possible.
- Incorporating guards/guides will prevent waste from ending up on the floor. Once on the floor it should be picked up as soon as possible.
- Catch baskets should be positioned to ensure all waste is caught and they should be emptied regularly.

3.6 Enrobing

3.6.1 Effluent Production

Problem areas:

- Although the effluent from this area is disposed of separately and not down the drain, it is a waste of resources to allow large amounts of crumb/dry ingredients onto the floor. Disposal charges will also be higher than necessary.

Recommendations:

- Prevent ingredients from ending up on the floor to reduce wastage and disposal costs by improving equipment guards/dispensing systems, fitting catch trays where appropriate and ensuring conveyors are aligned properly.

3.7 Drainage and Drain Catch Baskets

3.7.1 Water Use

- Most of the drain covers are of a complex design with large apertures. Removing each individual component for cleaning and disinfection would be very time consuming as well as requiring a great deal of water. Simpler drilled covers may be more suitable.

3.7.2 Effluent Production

Problem areas:

- Ineffective drain covers with large apertures allow waste to easily enter the drain.
- Waste separation in the drains consists of either crude catch baskets or separator grids across the opening of the drains. Both of these are ineffective, allowing waste to easily enter the drain and permitting the effluent to wash through the waste and so increasing effluent strength.

Recommendations:

- Drain covers should be replaced with smaller aperture covers. Covers with 15 mm diameter holes have been found effective at preventing waste from entering the drain in a whitefish company (see Seafish Guidelines).
- Install effective wedge wire drain catch baskets in processing areas (see Seafish Guidelines). In trials in whitefish factories these separator catch baskets have reduced effluent strength by about 50%.

4. Conclusions

4.1 Water Use

The complexity of the operation meant that it was impossible to assess water use within the scope of this brief study. However, the company is very aware of water use and have attempted to reduce it to the minimum possible without affecting hygiene, the product or the operation of equipment. It is unlikely that large further water savings could be made through waste minimisation. The current level of awareness should be maintained and any further opportunities for reductions identified over time by monitoring all water use areas in relation to throughput.

4.2 Effluent Production

When the Mogden formula comes into effect it will be particularly important to reduce the strength of the effluent generated. The main sources of high strength effluent are cooking and peeling operations. Priority should be given to prevent waste left soaking or ending upon the floor and passing down the drains. Effective drain catch baskets should be installed to reduce the strength of effluent leaving the factory.

Again it is difficult to draw conclusions for such a complex operation, but it is estimated that a 40% reduction in effluent strength could be achieved by implementing the waste minimisation measures outlined in this report and in the Seafish Guidelines.

Appendix I

Estimates of the Cost of Waste Minimisation

It must be recognised that there are costs associated with waste minimisation. These costs must be included in the strategic study as well as the savings made from minimising water supply and effluent discharge bills.

The costs can be broadly divided into the direct costs associated with modifying or installing new equipment and carrying out new working practices; and the indirect costs of training staff, carrying out water and effluent audits and monitoring performance. These indirect costs are very largely a matter of staff time.

Experience suggests that significant reductions in water use and effluent strength can be made at no or low cost and over a short timescale — for example by turning off the water at break times and by shovelling waste up off the floor rather than flushing it down into the drains — but that further savings may require further study and investment in equipment and will take longer to deliver.

Based on the brief visits to each of the sample businesses, the costs of carrying out the recommended waste minimisation measures have been estimated. It must be emphasised that these estimates can only be considered as gross approximations for the purpose of establishing indicative levels of cost for the strategic study. Indeed the estimates include the costs of training key personnel and carrying out a detailed water and effluent audit of each business; and only after that has been done can the required waste minimisation measures and costs be specified more precisely.

The costs have been calculated on the following basis:

Time Period

It is assumed that training, waste audits and waste minimisation measures are all carried out during a period of one year. The capital costs involved may be discounted over a larger period in the strategic study. Some of the costs, e.g. of carrying out the new practices, will be repeated in subsequent years.

Physical Changes

New items — generally based on knowledge of actual levels of cost from manufacturers/fabricators for Seafish work.

Modifications — generally based on knowledge of actual levels of cost from fabricators for Seafish work.

Installation — it is crudely assumed that the cost of installing new equipment will be equal to the purchase price of the equipment.

Staff Time Costs

Time — based on estimates of the staff time necessary to carry out the task.

Costs — based on employment costs for the appropriate category of staff taken from the 1995 Seafish Processors Survey, with a factor of 1.084 for inflation. This includes NI, tax, etc.

Audit Costs

Staff Time Required — based on Seafish experience of carrying out detailed audits.

Metering and Sample Analysis — based on costs of purchasing meters and taking samples to the extent appropriate for each type and scale of business from Seafish experience of carrying out detailed audits.

Training Costs

Waste Champion — based on Seafish Training Division time estimates for training suitable person and providing the necessary training materials.

Staff Training (by Waste Champion) — based on each of the staff receiving two hours basic training.

Although all of the above has been accounted for, it may be the case that businesses have suitable maintenance personnel to carry out much of the modification/installation work themselves and that significant parts of the various staff time costs involved in waste minimisation (e.g. for training) can be absorbed by businesses without increasing total wage costs.

Estimated Costs of Implementing Waste Minimisation

Recommendations	Cost of purchase and installation (£)
Washing and Grading	
Install effective catch basket to equipment	700
Improve grader chutes	500
Mechanised Peeling	
Install flow regulator	20
Install guards to ensure catch basket remains in place	200
Manual Peeling	
Introduce waste chutes to each station	3400
Introduce effective catch tray under each station and guards to keep in place	2040
Borealis Line	
Introduce guards onto chutes to prevent waste falling off	240
Screening Area	
Introduce guards / guides to prevent waste falling on the floor	800
Enrobing	
Improve the dispensing systems	1500
Cleaning	
Use trigger sprays on open hosepipes	300
Regularly squeegee all areas throughout the day*	1600
Develop and manage an effective cleaning schedule*	255
Drainage and Catch Baskets	
Smaller aperture drain covers	3500
Separator catch baskets	7200
Subtotal	**22,255**
Introduction of Waste Management Programme*	
Obtain management commitment Establish action plan Designate project responsibility Allocate resources	255
Carry out initial water and effluent audit	2705
Select appropriate waste minimisation measures	1700
Implement waste minimisation programme	425
Train all personnel	3575
Monitor and review programme	425
Subtotal	**9,085**
Overall Total	**31,340**

* involves mainly the cost of personnel time over one year